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Motivational Interviewing Technical Process and Moderated Relational Process with Underage Young Adult Heavy Drinkers

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Abstract

This study tested technical and relational processes hypothesized to explain the therapeutic benefit of an efficacious brief motivational interview (BMI). A randomized controlled trial compared the efficacy of a BMI to an attention-matched control (i.e., relaxation training [REL]) for reducing heavy alcohol consumption and associated negative consequences. Participants were underage, past-month heavy drinkers recruited from community settings ($N = 167$; ages 17–20; 62% female; 59% White). Data were collected on session recordings, using established motivational interviewing process measures. Statistical analyses followed three steps. First, a latent class model determined the optimal class solution for characterizing proportion change talk means within BMI and REL. Next, the probability of proportion change talk class membership was examined as a mediator and then as a moderated mediator of BMI efficacy. The latent class model yielded a 3-class solution, including a low-increasing proportion change talk class ($n = 61$), a moderate-increasing proportion change talk class ($n = 97$), and a nonlinear proportion change talk class ($n = 7$). Across the outcomes examined, membership in the moderate-increasing class rather than the low-increasing class mediated BMI effects on alcohol-related consequences at 6 weeks. Mediation tests for consequences at 3 months and heavy drinking were non-significant. Moderated mediation results for therapist empathy and MI Spirit were non significant.

Conclusions.—Findings suggest that moderate increases in pro-change statements, relative to anti- or neutral-change statements, help explain BMI effects on reducing alcohol-related negative consequences soon after intervention.

Keywords

Change talk; Mediation; Moderated Mediation; Motivational Interviewing; Young Adults

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Introduction

Brief interventions, based on the principles of motivational interviewing (MI; Miller & Rollnick, 2013), have resulted in reduced alcohol use among college students (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Carey, Scott-Sheldon, Elliot, Garey, & Carey, 2012), but less is known about intervention efficacy with young people not attending a four-year college or university. Even among college students, research on MI causal process is in its infancy, and there are no known studies with community-dwelling, underage drinkers. Proposed processes of MI include both technical and relational factors that are hypothesized to account, at least in part, for intervention effectiveness in relation to behavior change (Miller & Rose, 2009). Recently, understanding whether MI processes operate differently in varying contextual conditions has become a topic of interest. This research direction has been driven by the emphasis on personalized medicine within the National Institutes of Health (e.g., National Institute on Alcohol Abuse and Alcoholism Strategic Plan [NIAAA], 2017), a growing recognition of the possibility of conditional indirect effects (e.g., Preacher, Rucker, & Hayes, 2007), and advances in the ease of testing moderated mediation (e.g., Hayes, 2013). The goal is to optimize care via identification of the key processes involved in behavior change, and to consider whether these processes vary within specific client populations, clinical circumstances, and/or treatment settings.

Research on MI Technical and Relational Processes

Miller and Rose (2009) proposed two essential processes within the MI theoretical model - technical and relational. Specifically, the technical hypothesis asserts that therapeutic benefit can be explained by therapist use of MI consistent skills (i.e., frequency of enacted skills such as open questions, simple and complex reflections), which results in increases in positive client language about behavior change (i.e., change talk) and decreases in negative client language about behavior change (i.e., sustain talk; Miller & Rose, 2009). Some studies have supported the MI technical hypothesis using a within-condition, statistical mediation model (Barnett et al., 2014; Houck, Manuel, & Moyers, 2018; Moyers, Martin, Houck, Christopher, & Tonigan, 2009). In addition, a recent meta-analysis of 36 MI process studies showed that greater proportion of MI consistent skills (i.e., MI consistent skills/MI consistent skills + MI inconsistent skills + other skills) was related to a greater proportion of change talk (change talk/change talk + sustain talk), and in turn, a greater proportion of change talk was related to greater risk behavior reduction (Magill et al., 2018). This suggests overall, albeit observational, support for the technical hypothesis. Consistent with other meta-analytic reviews (Magill et al., 2014; Pace et al., 2017), heterogeneity in some path effect sizes was observed, which suggests that the processes of interest could be furthered specified with moderator analyses.

The relational hypothesis asserts that a therapist's skillful demonstration of empathy and MI Spirit will result in positive changes in a client's within- and post-session behaviors (Miller & Rose, 2009). Although of central interest to MI theorists and developers, the relational hypothesis has received relatively less empirical attention in the process literature. Studies have shown therapist within-session empathy was related to positive outcomes for adult emergency department (Gaume, Gmel, & Daeppen, 2008) and college student (McNally,

Palfai, & Kahler, 2005) alcohol users receiving a BMI. On average, however, meta-analyses have not supported the relational hypothesis when tested as a direct effect on client behavior change (Magill et al., 2018; Pace et al., 2017).

Research on MI Processes with Young Adults

The available MI process literature with young people has most often used data collected from college students (e.g., Borsari et al., 2015; Vader, Walters, Prabhu, Houck, & Field, 2010) and adolescents (e.g., Baer, Beadnell, Hartzler, Wells, & Peterson, 2008; Barnett et al., 2014; D'Amico et al., 2015). In one college-based study, the use of certain MI consistent skills characteristic of lower proficiency (i.e., reliance on simple rather than complex reflections) predicted worse alcohol outcomes at follow up (Tollison et al., 2008). This suggests there might be a need for better MI technique when working with young, non-treatment seeking individuals. Similarly, in a study with community-based young men in Switzerland, the technical hypothesis was supported only when therapist experience and client problem severity were high (Gaume et al., 2014). Research also suggests the negative side of client ambivalence, or sustain talk, might be a particularly important process to consider when college students are mandated to brief alcohol intervention (Apodaca et al., 2014; Borsari et al., 2015). Data from the Swiss, young adult male sample noted above, have suggested that even non-committal or weak change talk statements relate to worse outcomes following brief intervention, when readiness to change and problem severity were low (Gaume et al., 2016). Taken together, there is emerging research on MI processes with young adults, but these studies often target college students and the results suggest that technical processes could operate in a manner that is contrary to theoretical expectations among some young adult populations.

Non-College Young Adults

The majority of young adults in the United States are not enrolled and do not intend to enroll in a four-year college or university, and theoretical and epidemiological efforts are beginning to consider whether non-college and college youth are distinct emerging adult populations. When drinking trajectories among college and non-college attendees are compared, findings have been mixed. Recent research, however, shows there may be higher rates of long-term heavy alcohol consumption among young adults not attending a full-time college or university (Hingson, Zha, & Smyth, 2017; Hingson, Zha, & White, 2017). Research has also examined factors that might help explain educational status differences in drinking over time and show certain socio-economic and trait-level protective factors among college students (Quinn & Fromme, 2011). Economic trajectories are also less promising for non-college young adults, including income and reliance on external financial supports such as familial or governmental resources (Mitchell & Syed, 2015). These vulnerabilities could confer their own risk for drinking in middle adulthood. The extant literature argues that developmental context indeed differs between college and non-college young adults, but heterogeneity also exists within these groups (Arnett & Tanner, 2011). From an intervention standpoint, a recent meta-analysis examined 18 clinical trials with non-college or mixed college and non-college samples, and reported a small but statistically significant effect size in contrast to minimal or no treatment (Davis, Smith, & Briley, 2017). While the close to 20 studies targeting this population is a somewhat heartening number, substance use outcomes and

modalities of intervention were variable in the sample. As such, data on BMI among non-college attending young adults remain important and needed. When the paucity of process data within this population is also considered, the potential of the present study becomes even more evident.

The Parent Trial

In a randomized clinical trial that recruited non-college heavy drinkers who were not of legal drinking age, BMI was found to be more efficacious than an attention-matched control (i.e., relaxation training [REL]) for reducing alcohol use and related harm over two follow-up time points (i.e., 6 weeks, 3 months; Colby et al., 2018). An analysis of self-reported, post-session mediators showed some of the processes accounting for these differences were those typically supported in the adult, rather than college-based, BMI literature. For example, enhanced motivation and self-efficacy and decreased drinking intentions mediated alcohol outcomes at 6-week follow up, while greater use of specific behavioral strategies (i.e., avoidance of drinking situations and seeking alternatives to drinking) mediated alcohol outcomes at 3 months (Magill et al., 2017). These findings support BMI as a viable brief alcohol intervention for settings serving community-based young adults (e.g., GED training programs; vocational and two-year educational settings; employee assistance programs), but current implementation and/or training models lack specific clinical process information for this population. To bridge this gap, the current study examined technical and relational processes hypothesized to explain the therapeutic benefit of an efficacious brief motivational interview. The key questions were whether within-session language about change mediated 6-week and 3-month BMI outcomes, and whether this technical process was moderated by relational process.

The Current Study

This study examined technical and relational process in a sample of community-based, underage heavy drinkers receiving a brief alcohol intervention. First, we sought to describe how client language would manifest not only in BMI, but also in the attention-matched control condition (REL). Because REL was designed to control for therapeutic contact and expectancy for drinking behavior change, we did not know how client language would emerge in these sessions. By applying latent class models (LCA; Bartholomew, 1987; McCutcheon, 1987), we sought to characterize common patterns, or classes, of language manifestation over the course of the sessions. Second, using the identified latent class models, we examined the technical hypothesis as a statistical mediation model that was expected to apply to BMI, but not to REL in a between-condition analysis. Specifically, we tested whether membership in an increasing proportion change talk class, rather than in another class, mediated BMI efficacy in relation to client alcohol use and consequences at follow up. This is, to our knowledge, the first between-condition test of the technical hypothesis in the MI process literature. Finally, we tested whether the proposed mediation model would be moderated by the quality of the therapeutic relationship. Specifically, the strongest indirect effects were expected when observer ratings of therapist empathy and MI Spirit were above proficiency. Overall, this study offers a comprehensive and stringent test of technical and relational MI processes in an understudied young adult population.

Method

The Clinical Trial

In the parent study, BMI was compared to an attention-matched relaxation training control condition (REL) for reducing drinking and related harm in a community-based sample (Colby et al., 2018). The BMI condition was adapted to incorporate the transition out of high school for young adults not immediately bound for a traditional four-year college. Inclusion criteria were: a) underage drinkers between the ages of 17 and 20, b) one or more occasions of past-month heavy drinking (4 drinks for females; 5 or more drinks for males), and c) not currently enrolled nor intending to enroll at a four-year college or university. Motivation to reduce alcohol use was not a requirement to participate.

Participants were recruited from a range of settings, including high schools, social service agencies, GED classes, vocational and technical training programs, and community colleges. The interventions took place immediately following baseline assessment, post-tests were self-reported, and follow-up interviews were conducted in person at 6 weeks and 3 months (follow-up rate > 90%). The study sample was 168, with one session recording lost due to technical failure and two lost due to missing outcome data (final $N = 165$). The average age of participants was 18.2 ($SD = 0.98$) and the sample was 62% female. Participant self-identified race and ethnicity were as follows: 59% non-Hispanic White, 10% non-Hispanic Black/African American, 11% Hispanic, and 14% identified as more than one race. Drinking among participants included 28% past-month heavy drinking days ($SD = 19\%$) and a typical estimated Blood Alcohol Concentration (eBAC) of .21 ($SD = .14$) at baseline. All procedures were approved by the university Institutional Review Board and participants gave written informed consent.

The Interventions

BMI Intervention.—The BMI condition followed a manualized format, where some aspects of the discussions incorporated topics related to young adult transitions (e.g., life goals, work and family roles). The session began with exploration, eliciting information about the developmental context of drinking behavior. The therapist explored the positive and negative aspects of alcohol use and provided personalized feedback. For the personalized feedback report, information on: 1) past-month frequency and quantity of drinking; 2) past-month typical and peak eBAC; 3) alcohol-related consequences and risk factors; and 4) priority placed on alcohol (e.g., proportion of disposable income spent on alcohol; time allocated to alcohol consumption), was provided. Participants were asked to envision themselves in the future if they decided to make a change in their drinking, and then to envision their future if they did not change their drinking. For those interested, a collaborative Change Plan was completed. Throughout the session, the therapist utilized MI principles and techniques, including respecting autonomy, asking open-ended questions, practicing reflective listening, eliciting change talk, and supporting self-efficacy (Miller & Rollnick, 2002).

REL Intervention.—The REL condition was designed to control for nonspecific factors such as therapeutic contact and expectancy for drinking behavior change. The session began

with the rationale for treatment, with the therapist stating: “Life transitions during young adulthood can be stressful, and learning effective ways to cope with stress might reduce the likelihood of problematic alcohol use.” The exploration phase included the participant’s typical level of daily stress and reviewed current coping behaviors. To promote treatment expectancies, a rationale and two instructional exercises were conducted (i.e., mindfulness meditation and progressive muscle relaxation). The session concluded with a recommendation that the participant practice these techniques regularly.

Study interventions were provided by the same therapists across conditions (i.e., two PhD-level clinical psychologists and one BA-level counselor with several years of counseling experience). Training was comprised of approximately 40 hours of didactic instruction and role-play techniques. Fidelity to each intervention was monitored weekly with supervision and assessments independently completed by the therapists and participants (Colby et al., 2018). The conditions showed fidelity as indicated by observer ratings (e.g., proportion of MI-consistent clinician behaviors ($M(SD)_{BMI} = 0.96(0.02)$, $M(SD)_{REL} = 0.25(0.12)$, $t(166) = 52.49$, $p < .001$); see Table 1 for empathy and MI Spirit ratings by condition).

Measurement

Process Coding Procedure.—Process data collection occurred in three steps: 1) audio session files were parsed, which involves manually dividing statements into utterances, 2) therapist and client codes were applied to each utterance, and 3) each coded file was assigned relational skillfulness ratings. Data were collected via the CASAA Application for Client Therapist Interactions (CACTI; Glynn, Hallgren, Houck, & Moyers, 2012). Two bachelor-level, independent coders performed all project data coding, under the weekly supervision of the first and third authors. The coders were provided minimal information on the original clinical trial aims and had no access to the outcome data. Training occurred in three phases: 1) didactic overview, including treatment- and coding-related readings (i.e., Houck, Moyers, Miller, Glynn, & Hallgren, 2010; Magill & Apodaca, 2011; Miller & Rollnick, 2013), 2) group coding practice with corrective feedback, and 3) individual coding practice with group corrective feedback. The training process required roughly 60 hours of instruction to achieve proficiency defined by Intraclass Correlation Coefficient (ICC; two-way mixed; single measure) values of .75 or above (Cicchetti, 1994) for continuous measures and Cohen’s weighted (quadratic weight) Kappa values of .60 or above (Landis & Koch, 1977) for ordinal measures. Throughout data collection, weekly coding laboratory meetings were conducted to maintain rater alignment via group exercises, discussion of difficult items, and resolution of discrepancies. Project inter-rater reliability assessment included a 20% random sample of session files for double coding, and reliability was evaluated in 8-month increments.

Client Language Measures.—The current study used a single indicator for the proposed mediation analyses. Client change language was measured with the Client Language Assessment – Proximal/Distal (CLA-PD; Magill & Apodaca, 2011; Magill et al., 2016). The five CLA-PD items (i.e., Reasons, Commitments, Abilities, Taking Steps, Other) are derived from the client portion of the Motivational Interviewing Skill Code (MISC 2.5; Houck et al., 2010), but are adapted to distinguish statements regarding Proximal-Coping (e.g., “I will tell

my friends that I am trying to cut down on my drinking” = Commitment-Proximal towards change) from Distal-Drinking (e.g., “I will cut down on my drinking” = Commitment-Distal towards change) behaviors. The intent of the CLA-PD is to allow for assessment of language in behavior change interventions that incorporate some type of coping skills training (Magill et al., 2016). Each distal or proximal code requires a subsequent valence (i.e., toward or away from change) that is coded for frequency and strength (3-point scale). When client statements contain no motivational content (e.g., “I drink one day a week”), they received a code of neutral. For the present report, proportion change talk was calculated and used as an indicator of the proportion of all within-session client statements that were in favor of making a change (i.e., change talk). The CLA-PD proximal-distal distinction is the topic of another report (Walthers et al., under review).

Therapist Relational Measures.—The current study used two indicators for the proposed moderated mediation analyses. First, empathy was defined by therapist accurate reflective listening. Second, MI Spirit was defined by an average rating of therapist Evocation, Collaboration, and support for client Autonomy. These measures are derived from the MISC (Houck et al., 2010) and are referred to as “global ratings.” MISC global ratings are assessed on a 5-point Likert scale, where average proficiency receives a rating of 3. For the current study, a rating of 3 or lower was equivalent to “average or below average” versus a rating of 4 or higher was “good”.

Follow-up Outcome Measures.—A 6-week Timeline Follow Back (TLFB; Sobell & Sobell, 1992; 1995) was used to measure alcohol consumption at 6-week and 3-month follow ups. The calendar-assisted interview yields estimates for the number of standard drinks consumed daily at each follow up. For the current study, the percentage of heavy drinking days was calculated (i.e., percentage of days on which 4 or more drinks were consumed for women or 5 or more drinks for men). The Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler, Strong, & Read, 2005) was used to assess whether participants had experienced each of 24 negative alcohol-related consequences in the past 6 weeks (items are summed for a total score; Cronbach’s $\alpha = .81$ in the current sample).

Analytic Strategy

Latent Classes of Proportion Change Talk.—We used latent class analysis (LCA; Bartholomew, 1987; McCutcheon, 1987) to identify the optimal number of classes that would characterize proportion change talk across session quintiles (i.e., five equal units of time) in BMI and REL. LCA is intended to detect unobserved subpopulations of clients with similar mean proportion change talk scores at each unit of time¹. Given an optimal solution, each client has a numeric value that reflects their most likely class membership. We evaluated the Bayesian Information Criterion (BIC; Schwarz, 1978) fit index and a likelihood ratio test for relative improvement in model fit (VLMR test; Lo, Mendell, & Rubin, 2011) to determine the optimal number of classes. We also considered the parsimony

¹One alternative to LCA, is to use Latent Growth Curve Modeling, which would have characterized quintile means as a linear and/or quadratic slope over the course of the session. However, this method did not fit the data due to substantial variability around a single mean trajectory for client change language.

of the model and the interpretability of classes when selection the final class solution. Following the methods of Asparouhov and Muthén (Three-Step Approach; 2014), we then saved the following variables: 1) most likely class membership and 2) the probability of class membership for each of the classes. Subsequently, we used these estimates in mediation and moderated mediation analyses. Specifically, the model uses the individual probability of class assignment to train the fixed latent class configuration in order to reflect the uncertainty of class assignment (Asparouhov & Muthén, 2014).

Mediation and Moderated Mediation with Proportion Change Talk Class.—To test whether the effect of condition was mediated by a nominal mediator (i.e., the proportion change talk class membership) and whether this mediation was dependent on relational moderators (i.e., empathy, MI Spirit), we ran structural equation models investigating whether outcome means (i.e., percent of heavy drinking days, alcohol-related consequences) differed from a reference class (Muthén & Muthén, 2017). Specifically, the mean of the outcome variable was transformed to be equal to zero for a reference proportion change talk class. Next, we estimated the outcome mean independently for other classes, effectively evaluating whether it differed significantly from the reference class. To assess mediation effects, we estimated bootstrapped joint significance for the indirect effect (MacKinnon, Lockwood, & Williams, 2004) using 5000 bootstrapped samples. Model output included bootstrapped confidence intervals for the product of the effect of the *a*-path (i.e., effect of condition on probability of proportion change talk class membership) and the *b*-path (i.e., effect of proportion change talk class membership on the latent outcome mean), and *ab*-path relationships at conditional values of the moderator (i.e., 0/1 for empathy, MI Spirit). Analyses adjusted for the baseline value of the relevant outcome variable.

Results

Descriptive analyses and interrater reliability data for study process variables can be found in Table 1. These results supported discriminability between conditions with respect to client language and relational skill. Specifically, therapists in the BMI condition showed significantly higher empathy ($t(166) = 11.68, p < .001$) and MI Spirit ($t(166) = 19.15, p < .001$) than did those in the REL condition. Clients in the BMI condition showed significantly higher frequency of change talk ($t(163) = 23.37, p < .001$) and sustain talk ($t(163) = 18.94, p < .001$) than did their REL counterparts. The BMI condition also had a significantly higher overall proportion of utterances that were classified as change talk ($t(166) = 9.19, p < .001$).

Class Solution for Proportion Change Talk

Table 2 contains fit statistics and frequency of participants for the proportion change talk class solutions. These statistics indicated that a 3-class model best fit the data for proportion change talk over session quintiles. These proportion change talk classes reflected: a low starting, but increasing class (C1: *low-increasing proportion change talk class*, $n = 61$), a more moderate starting, and increasing class (C2: *moderate-increasing proportion change talk class*, $n = 97$), and a nonlinear class (C3: *nonlinear proportion change talk class*, $n = 7$). For a pictorial view, Figure 1 shows the estimated means for proportion change talk in each class by session quintile. Next, Table 3 shows study relational and outcome data for each

proportion change talk class. Members of the low-increasing (69%) and non-linear classes (100%) were primarily REL recipients, while the moderate-increasing class members were majority BMI recipients (65%). Correspondingly, the highest mean relational scores for empathy and MI Spirit were for those within the moderate-increasing class. For drinking and consequence outcomes, the means were not significantly different between classes.

Proportion Change Talk Class as a Mediator of MI Efficacy on Follow up Outcomes

Table 4 shows the mediation findings by membership in proportion change talk class. With the low-increasing proportion change talk class as the reference, the results showed greater likelihood of membership in the moderate-increasing proportion change talk class mediated BMI efficacy for reduced 6-week alcohol-related consequences (*ab est.* = -2.23 (95% bootCI: $-4.24, -0.82$), but not 3-month alcohol-related consequences or heavy drinking days at 6-week or 3-month follow ups. To better understand the nature of the 6-week heavy drinking mediated relationship, the direction of regression path coefficients can be considered. Here, the a-path coefficient showed that receipt of BMI, compared to REL, was associated with a more likely class membership in the moderate-increasing compared to low-increasing proportion change talk class. This likely class membership was then associated with a lower number of alcohol-related consequences at 6 weeks (*b*-path). Finally, analyses for the nonlinear class in reference to the low-increasing class are presented in Supplemental Table 1; this contrast was not of substantive interest due to very low class membership ($n = 7$; 4.2% of sample).

Do Relational Factors Moderate Technical Factors?

Table 5 shows the moderated mediation findings by membership in proportion change talk class. These model results indicated that the quality of the therapy relationship, as measured by empathy and MI Spirit global ratings (i.e., average versus good), did not moderate technical process mediation relationships. Specifically, mediation results for 6-week and 3-month heavy drinking days and alcohol-related consequences, at the conditional relational moderator values, were non-significant. Finally, moderated mediation analyses for the nonlinear class in reference to the low-increasing class are presented in Supplemental Table 2; this contrast was not of substantive interest due to very low class membership ($n = 7$; 4.2% of sample).

Discussion

This study examined technical and relational processes hypothesized to explain the therapeutic benefit of an efficacious BMI for reducing drinking behavior among community-based, underage heavy drinkers, which is a relatively under-studied population in alcohol intervention research (NIAAA, 2017). To our knowledge, this is also the first study to consider theorized MI processes in a between-rather than within-condition analysis. Such a design allows for a rigorous test of the model because we were able to establish that processes assumed to characterize experimental condition benefit were not also occurring in the control condition. In the parent clinical trial, BMI demonstrated efficacy over REL for reducing alcohol use and related consequences at follow up (Colby et al., 2018). The questions of the current report were - does technical process mediate BMI efficacy and does

level of relational proficiency better specify the technical mediation model? Results of this study can inform clinical care with young adult drinkers not seeking treatment, and particularly those not involved in a four-year college or university environment.

BMI Process in Contrast to REL

One question raised by process researchers has been – is the technical process, characterized by client-centered exploratory skills targeting client motivational enhancement, unique to MI or common to other behavior change modalities? Only a few studies have considered this question, and evidence shows change talk will manifest and relate to outcome in adult cognitive behavioral (Aharonovich, Amrhein, Bisaga, Nunes, & Hasin, 2008; Moyers, Martin, Christopher, et al., 2007) and twelve-step (Moyers, Martin, Christopher, et al., 2007) substance use interventions. These studies suggest the technical model could operate in other modalities, but we are not aware of previous between-condition tests of the full mediation model. The advantage of such a test is randomization at the condition to mechanism path (i.e., *implementation path*), and thus greater potential specificity in the support for the process model of interest (MacKinnon, 2008; O'Rourke & MacKinnon, 2018). In the current study, REL was designed as a control condition, accounting for therapeutic contact and expectancy for drinking behavior change; it was not designed to represent a specific, mindfulness-based intervention (e.g., Witkiewitz, Marlatt, & Walker, 2005). As a result, the current study should be considered a first-level test of the specificity of the MI technical model. With that caveat in mind, our results demonstrate BMI could be discriminated from REL with respect to key ingredients and purported mechanisms, which is support for the *a*-path, or *implementation success*.

When studying intervention processes, both the success of the implementation and of the theorized mechanism (*b*-path) should be considered (MacKinnon, 2008; O'Rourke & MacKinnon, 2018). In this study, we began with an exploratory approach to examining the purported mechanism given there was no empirical precedent for characterizing how client change language should manifest in the REL sessions. In contrast, the MI technical model proposes that, if successfully implemented with fidelity, client change talk will increase and sustain talk will decrease over the course of the session (Miller & Rose, 2009; Miller & Rollnick, 2013). The latent class model yielded a 3-class solution, and two of these classes were of particular interest due to their substantive trajectories (i.e., linearity) and more pragmatically, the adequacy of their cell sizes. For the low-increasing and moderate-increasing proportion change talk classes, likely class membership showed low-increasing class members were most often REL recipients. In contrast, moderate-increasing class members were most often recipients of BMI. These results suggest that, among these community-based young adults, receiving BMI, rather than REL, was associated with greater motivational enhancement with respect to behavior change, and this observation is consistent with differential changes in self-reported motivation observed in the parent trial (Magill et al., 2017). However, the test of *theory success*, as represented by the moderate-increasing proportion change talk class, lies in the potential relationship between likely class membership and client outcomes at follow up (*b*-path).

Mediation and Moderated Mediation of Proportion Change Talk Class

This study found that membership in a moderate-increasing proportion change talk class rather than a low-increasing change talk class mediated the effect of BMI, in contrast to REL, on negative alcohol-related consequences at 6-week follow-up. This finding provides support for the theorized technical model in relation to early follow-up consequences in a community-based, racially and ethnically diverse, and non-treatment seeking young adult sample. However, the technical mediation model was not supported for later follow-up consequences or heavy drinking outcomes. In the only other study that has utilized a latent class model approach, membership in an increasing proportion change talk class was not associated with follow-up alcohol consumption or consequences among mandated college student alcohol users (Borsari et al., 2018). Among adults, however, a mediated effect for client change talk in relation to alcohol consumption has been observed within treatment (Moyers et al., 2009) and more recently, one year following treatment (Houck, Manuel, & Moyers, 2018). In another adult study, two versions of MI were contrasted, a technical-focus MI and a relational-focus MI, and while mediation via client commitment language was not observed at the end of treatment, it was observed during treatment (Morgenstern et al., 2012). Taken together, studies continue to suggest the technical mediation model is only modestly understood, and that support varies by length of follow up and type of outcome, and may differ across college, non-college, and adult populations.

Finally, we examined whether the mediated effect for the moderate-increasing class in contrast to the low-increasing class would be strongest when relational measures indicated good, rather than average or lower relational proficiency. These models showed larger *ab* coefficients at high versus low relational proficiency, but moderated indirect effects were not statistically significant. This non-significant result was unexpected, given the theoretical emphasis placed on relational factors within the MI literature (e.g., Miller & Rose, 2009; Moyers & Miller, 2013). Perhaps technical and relational is a false dichotomy, at least in the manner studied here. In other words, it may not be possible to disentangle the MI technique from the MI relationship. Even among the optimal conditions of a randomized contrast, tests of the relative predictive validity of MI technical and relational elements have been unsupported (Morgenstern et al., 2012; 2017). Because of its centrality in MI theory, relational process and the ideal approaches to examining the predictive value of the MI relationship warrant continued study.

Limitations and Future Research Implications

This study has some key limitations to consider. The models tested were designed to balance considerations of parsimony with sensitivity to valid tests of MI process theory, but these models were powered to detect moderate or stronger (Fritz & MacKinnon, 2007) indirect effects. Therefore, the present study could have been underpowered to detect small effect sizes for the *ab* estimate. Similarly, the number of participants contributing to each moderation contrast was relatively low. As such, tests of conditional indirect effects, where indirect effects are small in magnitude, should be conducted with a larger sample. The small-sized, non-linear class was comprised of seven REL participants who engaged in minimal discussion of their experience after the session exercise (see Supplemental Figure 1). This speaks to the nature of the contrast control, which included a skill-building

component, and suggests a need to conduct future between-condition studies with a broader range of interventions. Finally, participants were recruited from various community service and educational settings (e.g., GED programs or vocational training) and this might affect study generalizability. However, we view the study sample positively, given it captures a low-resource, racially and ethnically diverse, and understudied population of underage young adults potentially at risk for persistent heavy alcohol use and related consequences.

Conclusions

A key focus of this study was to consider if mechanisms, commonly tested within the MI process literature, were operative when a BMI was delivered to young adult drinkers who were not enrolled in a traditional four-year college or university. Study results suggest technical and relational processes were present in the BMI condition, and much less so in the REL condition, and technical process partially explained BMI benefit on alcohol consequences soon after treatment completion.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Line plot of proportion change talk by session quintile

Table 1.

Descriptive data on process variables and rater reliability

	REL <i>M (SD)</i> (<i>n</i> =83)	BMI <i>M (SD)</i> (<i>n</i> =82)	<i>p</i>	ICC	<i>k</i>
Session Length in Minutes	41.56(8.02)	54.33(12.09)	<.001		
Within Session Process Measures					
Sum of Change Talk	6.72(5.87)	87.50(30.93)	<.001	.985	
Sum of Sustain Talk	2.01(3.09)	36.82(16.46)	<.001	.965	
Sum of Follow/Neutral	27.58(17.99)	160.95(61.77)	<.001	.996	
Proportion of Change Talk	.18(.10)	.31(.09)	<.001	.876	
Utterance Level Agreement					.779
Global Empathy	2.65(.66)	3.83(.66)	<.001	.830	.704
Global MI Spirit	2.46(.39)	3.76(.48)	<.001	.901	.810

Notes. BMI = Brief motivational interviewing; MI = Motivational interviewing; REL = Relaxation training. Cicchetti (1994) suggests the following guidelines for assessing reliability of observational coding systems: ICC of .75 or above = excellent; .60-.74 = good; .40-.59 = fair; below .40 = poor. Landis and Koch (1977) suggest the following for assessing interrater agreement via Cohen's Kappa (k): below 0.0 Poor; 0.00 – 0.20 Slight; 0.21 – 0.40 Fair; 0.41 – 0.60 Moderate; 0.61 – 0.80 Substantial; 0.81 – 1.00 Almost perfect.

Table 2.

Model statistics and estimated class memberships for class solutions

	BIC	VLMR	entropy	C1 <i>n</i>	C2 <i>n</i>	C3 <i>n</i>	C4 <i>n</i>
1-class	-503.9			165			
2-class	-539.0	<.01	.685	61	104		
3-class^a	-549.6	<.01	.796	61	97	7	
4-class	-554.0	.40	.771	57	22	79	7
5-class	-						

Notes. Bayesian Information Criterion (BIC) is a measure of model fit where lower values, based on model parsimony, are preferred. The Vuong-Lo-Mendel-Rubin (VLMR) tests the significance of improvement of model fit (based on loglikelihood reduction) compared to a model with one fewer classes. Entropy indicates the accuracy of classification based on the probability of assignment to each individual's most likely class membership.

^aFinal selected model in bold.

Table 3.

Relational and outcome data by proportion change talk class membership

Intervention Condition	mod-increasing (n=97)	low-increasing (n=61)	non-linear (n=7)	(p)
BMI				
BMI	64.9%	31.1%	0%	
REL	35.1%	68.9%	100%	<.001
Relational Measures				
Global Empathy	3.51(0.83)	2.89(0.82)	2.57(0.53)	<.001
Global MI Spirit	3.35(0.79)	2.79(0.66)	2.43(0.32)	<.001
6 wk and 3 mo Follow up Outcomes				
6 wk percent heavy drinking days	10.81(13.38)	15.72(14.57)	19.39(28.55)	.068
3 mo percent heavy drinking days	9.68(12.15)	11.90(12.97)	11.22(11.31)	.553
6 wk alcohol-related consequences	5.54(4.81)	6.35(4.14)	6.57(5.29)	.537
3 mo alcohol-related consequences	5.42(4.37)	5.02(4.15)	5.86(4.37)	.809

Notes. BMI = Brief motivational interviewing; REL = Relaxation training; mod. = moderate; wk = week; mo = month. Alcohol-related consequences were assessed using the Brief Young Adult Alcohol Consequences Questionnaire (Kahler et al., 2005). Individual membership to the mod-increasing, low-increasing, and non-linear classes were established by saving the most likely class membership for each participant and comparing means between these classes.

Table 4.

Proportion change talk class as a mediator of MI efficacy on outcomes

		Effect C2>C1 ^a at 6 weeks			Effect C2>C1 ^a at 3 months		
		CI 2.5% lo	est.	CI 2.5% hi	CI 2.5% lo	est.	CI 2.5% hi
Heavy drinking days	c'	-9.25	-5.87	-2.26	-9.46	-5.91	-2.63
	a	0.74	1.32	1.91	0.74	1.32	1.91
	b	-5.96	-2.40	1.16	-3.70	-0.42	2.92
	mediation	-9.06	-3.18	1.16	-5.39	-0.55	4.00
Alcohol-related consequences	c'	-1.58	-0.48	0.70	-2.96	-1.83	-0.65
	a	0.73	1.32	1.90	0.73	1.32	1.90
	b	-2.72	-1.69	-0.71	-0.84	0.15	1.17
	mediation	-4.24	-2.23	-0.82	-1.19	0.20	1.60

Notes. *est.* = coefficient estimate. All estimates are bootstrapped (5000 samples).

^aBaseline-adjusted mediation of MI effect on drinking by probability of class membership in moderate-increasing change talk class (C2) compared to low-increasing change talk class (C1). c' = residual direct effect; a = class membership regressed on condition; b = outcome regressed on class membership; mediation indicated by the product of ab coefficients. Significant coefficient estimate at $\alpha = .05$ in bold.

Table 5.

Moderated mediation of proportion change talk class by relational moderators

		Effect C2>C1 ^a at 6 weeks			Effect C2>C1 ^a at 3 months		
		2.5% lo	est.	2.5% hi	2.5% lo	est.	2.5% hi
Heavy drinking days	Empathy						
	c'	-10.07	-4.76	2.78	-1.54	0.21	2.54
	A	-0.08	0.70	1.55	-0.09	0.70	1.57
	W	-5.09	0.05	4.20	-5.05	0.04	4.27
	Aw	-3.22	0.94	6.10	-3.22	0.95	6.11
	B	-6.49	-2.45	1.38	-0.22	0.66	1.68
	Low Mediation	-8.44	-1.73	0.44	-0.07	0.46	2.06
	Hi Mediation	-24.72	-4.04	3.65	-0.83	1.09	8.19
	Spirit						
	c'	-20.84	-11.50	-5.01	-2.64	-0.77	0.64
	A	-1.07	0.22	1.50	-1.06	0.21	1.57
	W	-5.06	0.03	4.32	-4.96	0.02	4.48
Alcohol consequences	Aw	-3.02	1.26	6.43	-3.22	1.26	6.14
	B	-6.77	-2.92	0.32	-0.35	0.48	1.37
	Low Mediation	-7.12	-0.63	2.26	-0.38	0.10	1.72
	Hi Mediation	-27.80	-4.29	3.43	-0.86	0.70	6.40
	c'	-1.98	-0.16	2.11	-3.63	-2.17	-0.52
	A	-0.09	0.70	1.57	-0.09	0.70	1.57
	W	-5.05	0.04	4.27	-5.05	0.04	4.27
	Aw	-3.22	0.95	6.11	-3.22	0.95	6.11
	B	-2.70	-1.66	-0.64	-0.88	0.12	1.12
	Low Mediation	-3.32	-1.16	0.03	-0.64	0.08	1.16
	Hi Mediation	-13.16	-2.74	2.92	-1.85	0.19	4.71
	Spirit						
	c'	-3.11	-0.33	2.63	-5.56	-3.45	-1.02
	A	-1.06	0.21	1.57	-1.06	0.21	1.57
	W	-4.96	0.02	4.48	-4.96	0.02	4.48
	Aw	-3.22	1.26	6.14	-3.22	1.26	6.14
	B	-2.73	-1.68	-0.71	-0.90	0.05	1.09
	Low Mediation	-2.96	-0.35	1.72	-0.59	0.01	1.01

		Effect C2>C1 ^a at 6 weeks			Effect C2>C1 ^a at 3 months		
		2.5% lo	est.	2.5% hi	2.5% lo	est.	2.5% hi
Hi	Mediation	-13.45	-2.47	3.51	-2.45	0.07	3.16

Notes. est. = coefficient estimate. All estimates are bootstrapped (5000 samples).

^aBaseline-adjusted mediation of MI effect on drinking by probability of class membership in moderate-increasing change talk class (C2) compared to low-increasing change talk class (C1). c' = residual direct effect; a = class membership regressed on condition; b = outcome regressed on class membership; w = conditional direct effect of the moderator; aw = a by w interaction; mediation indicated by the product of ab coefficients at conditional (i.e., low/high) values of the moderator. Significant coefficient estimate at $\alpha = .05$ in bold. Analyses conducted at $\pm 1 SD$ for the moderator showed a similar pattern of results.